THERMAL DYNAMICS®

35C

DRAG-GUN™ PLUS PLASMA CUTTING SYSTEM

Art # A-04718

Service Manual

Rev. AA.01 **Issue Date: March 26, 2007** **Manual 0-4751**

Operating Features:

PLASMA | 35 AMP | 1 PHASE | 230 V

WARNING

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Plasma Cutting Power Supply
Drag-Gun Plus
PCH 42 Torch
Service Manual Number 0-4751

Covered under U.S. Patents.

Published by:
Thermadyne Corporation
82 Benning Street
West Lebanon, New Hampshire, USA 03784
(603) 298-5711

www.thermal-dynamics.com

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Printed in the United States of America

Publication Date: March 26, 2007

Record the following information for Warranty purposes:

Where Purchased:_____

Purchase Date:_____

Power Supply Serial #:_____

Torch Serial #:_____

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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.

WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions

WARNING

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.

GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.

- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Sec. 25249.5 et seq.)

ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically “live” or “hot.”
- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.
- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.

FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.

NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.

PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.

- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018
6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: 82 Benning Street
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

The equipment described in this manual conforms to all applicable aspects and regulations of the "EMC Directive" (European Council Directive 89/336/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements. Among them are:

* CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.

* UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.

* CENELEC EN50199 EMC Product Standard for Arc Welding Equipment.

* ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.

* For environments with increased hazard of electrical shock, Power Supplies bearing the [S] mark conform to EN50192 when used in conjunction with hand torches with exposed cutting tips, if equipped with properly installed standoff guides.

* Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Operations Director
Thermadyne Europe
Europa Building
Chorley N Industrial Park
Chorley, Lancashire,
England PR6 7BX

CE

1.05 Statement of Warranty

LIMITED WARRANTY: Subject to the terms and conditions established below, Thermadyne® Corporation warrants to the original retail purchaser that new Thermadyne CutSkill Series plasma cutting systems sold after the effective date of this warranty are free of defects in material and workmanship. Should any failure to conform to this warranty appear within the applicable period stated below, Thermadyne Corporation shall, upon notification thereof and substantiation that the product has been stored operated and maintained in accordance with Thermadyne's specifications, instructions, recommendations and recognized industry practice, correct such defects by suitable repair or replacement.

T**his warranty is exclusive and in lieu of any warranty of merchantability or fitness for a particular purpose.**

Thermadyne will repair or replace, at its discretion, any warranted parts or components that fail due to defects in material or workmanship within the time periods set out below. Thermadyne Corporation must be notified within 30 days of any failure, at which time Thermadyne Corporation will provide instructions on the warranty procedures to be implemented.

Thermadyne Corporation will honor warranty claims submitted within the warranty periods listed below. All warranty periods begin on the date of sale of the product to the original retail customer or 1 year after sale to an authorized Thermadyne Distributor.

LIMITED WARRANTY PERIOD

Product	Power Supply Componants (Parts and Labor)	Torch and Leads (Parts and Labor)
Drag-Gun Plus	2 Year	1 Year

This warranty does not apply to:

1. Consumable Parts, such as tips, electrodes, shield cups, o - rings, starter cartridges, gas distributors, fuses, filters.
2. Equipment that has been modified by an unauthorized party, improperly installed, improperly operated or misused based upon industry standards.

In the event of a claim under this warranty, the remedies shall be, at the discretion of Thermadyne Corporation:

1. Repair of the defective product.
2. Replacement of the defective product.
3. Reimbursement of reasonable costs of repair when authorized in advance by Thermadyne.
4. Payment of credit up to the purchase price less reasonable depreciation based on actual use.

These remedies may be authorized by Thermadyne and are FOB West Lebanon, NH or an authorized Thermadyne service station. Product returned for service is at the owner's expense and no reimbursement of travel or transportation is authorized.

LIMITATION OF LIABILITY: Thermadyne Corporation shall not under any circumstances be liable for special or consequential damages such as, but not limited to, damage or loss of purchased or replacement goods or claims of customer of distributors (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermadyne with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of the goods covered by or furnished by Thermadyne whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which liability is based.

This warranty becomes invalid if replacement parts or accessories are used which may impair the safety or performance of any Thermadyne product.

This warranty is invalid if the Thermadyne product is sold by non - authorized persons.

Effective January 3, 2006

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SECTION 2: INTRODUCTION

2.01 INTRODUCTION

Plasma is a gas which has been heated to an extremely high temperature and ionized so that it becomes electrically conductive. The plasma arc cutting process uses this plasma to transfer an electrical arc to the workpiece. The metal to be cut is melted by the heat of the arc and then blown away.

2.02 GENERAL SPECIFICATION

Model Description	Drag-Gun Plus
Maximum output	35 Amps
Input Voltage & Phase	230V, Single Phase
Frequency	50/60Hz
Input power	8.3 kVA
Current Input fuse	U.S. / Canada 40 Amps All others 20A Slow Blow Fuse
No Load Voltage	330V
Load Voltage	94V
Output Current	10 - 35 Amps
Post flow time	15 Seconds
Duty cycle @ 104°F / 40° C Ambient	35% @ 35A @ 94vdc
	60% @ 27A @ 91vdc
	100% @ 20A @ 88 vdc
Genuine Cutting Capacity	3/8" (9 mm)
Maximum Cutting Capacity	1/2" (12mm)
Dimension (W * D * H)	10.5"x15.5"x11" (267 mm x 394 mm x 279 mm)

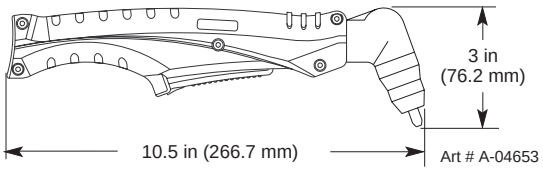
NOTE:

Refer to Local and National Codes or local authority having jurisdiction for proper wiring requirements.

2.03 Features

- COMPACT and LIGHT - Designed for easy transportation.
- ENERGY EFFICIENCY - Advanced technology reduces power consumption.
- HIGH SPEED GENUINE CUTTING - The constricted plasma arc provides high speed cutting as well as a good quality genuine, narrow cut.
- LOW COST WITH COMPRESSED AIR - The Drag-Gun Plus operates on compressed air.
- ALL KINDS OF METALS - Useful for most metals such as stainless steel, aluminum, mild steel, copper and their alloys.
- PILOT ARC IGNITION FROM TORCH - The Pilot Arc ignites the cutting arc.
- POWERFUL CUTTING PERFORMANCE - Genuine cutting capacity is 3/8" (9 mm).
- ABLE TO CUT PAINTED MATERIALS - Pilot Arc ignition allows the Drag-Gun Plus to cut painted materials.
- EXTENDED PARTS LIFE - Consumable parts life is longer.

2.04 Torch Specifications



PCH-42 Torch Ratings	
Torch Configuration	Torch Head at 70° to Torch Handle
Torch Leads Length	20 feet / 6.1 m
Ambient Temperature	104° F 40° C
Duty Cycle	100% @ 40 Amps @ 200 scfh
Maximum Current	40 Amps, DC, Straight Polarity
Voltage (V_{peak})	500V
Arc Striking Voltage	12kV
Type of Cooling	Ambient air and gas stream through torch
Parts-in-Place:	Built-in Switch in Torch Head
Gas Requirement:	Single Gas, Compressed Air Only
Input Gas Pressure	65 psi (4.5 bar) (.45MPa)- 125 psi (8.6 bar) (.86MPa)
Minimum Gas Flow	200 SCFH (142 lpm)
Direct Contact Hazard	For operation with exposed tip the recommended standoff height is 1/8 - 3/8" (3-9 mm).
Plasma Power Supply Used With:	Drag-Gun Plus

2.05 System Contents

Description	ITEMS	Q'ty
Power source	Model Drag-Gun Plus	1
Torch Set	PCH-42, with 20' (6.1 m) leads	1
Accessories & Consumables	Work Cable Manual Torch Electrodes Torch Tips	1 1 2 3
Input Power Cable U.S. / CAN.	3 Meter NEMA 10 AWG / 4.8 mm^2 with 6 - 50 P molded plug	1
Input Power Cable Outside of U.S. / CAN.	3 Meter 3x2.5 sq mm rubber wire	1

2.06 Transporting Methods

Lift unit with handle on top of case. Use handcart or similar device of adequate capacity for transporting.

WARNING

ELECTRIC SHOCK can kill. DO NOT TOUCH live electrical parts. Disconnect input power from supply before moving the power source.

FALLING EQUIPMENT can cause serious personal injury and equipment damage.

SECTION 3: INSTALLATION

3.01 Site Selection

- Place in a clean and dry area.
- Provide adequate ventilation and fresh air supply.
- Ideal ambient temperature should not exceed 40°C / 104°F. Temperatures exceeding that may diminish cutting capacity or quality.
- The cutting machine must be placed on an even, firm surface so that it stands firmly.

WARNING

This equipment must be electrically connected by a qualified electrician.

3.02 Electrical Input Connections

- Input voltage is 230V ± 10%, 50/60 Hz single phase.

CAUTION

Check your power source for correct voltage before plugging in or connecting the unit. The primary power source, fuse, and any extension cords used must conform to local electrical code and the recommended circuit protection and wiring requirements as specified in Section 2.

3.03 Torch

- Make sure that the torch cable and torch switch terminals are connected to front panel.
- Make sure the Work Cable is connected properly to front panel.
- Before activating, turn torch away from yourself and others.

DANGER

Do not cut in humid or wet surroundings.

- Before you maintain or replace torch parts, wait for the post flow air cycle (approximately 15 seconds), to stop, then turn the machine off.
- Always use original manufacturers parts. The use of aftermarket parts could result in lower parts life and in unsatisfactory cutting results. Any warranty claims would be waived.
- Recycle worn parts according to local requirements.

NOTE

Repairs must be done by skilled and qualified personnel only.

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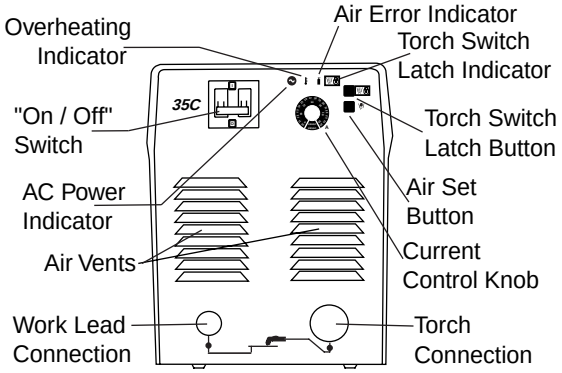
SECTION 4: OPERATION

4.01 Front Control Panel



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Roll bars not shown for clarity

A. INDICATOR LAMP

- Power Indicator - Lights when primary power switch is turned on.
- TEMPERATURE Indicator - Indicator is normally OFF. Indicator is ON when internal temperature exceeds normal limits. Shut unit OFF; let the unit cool before continuing operation.
- Air Error Indicator - This indicator lights and is accompanied by an intermittent audible tone when there is not enough air pressure to operate the power supply.

NOTE

It is possible to have enough air pressure to operate the power supply but not enough air flow to operate the torch.

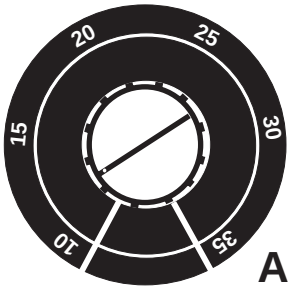
- Torch Switch Latch Indicator - This indicator lights when the Torch Switch Latch Button has been pressed for continuous cutting.

B. BUTTONS

- Torch Switch Latch Button - For continuous cutting performance. Depress this button (turn "On") while cutting with the torch. Release the torch trigger and the torch will continue to cut without depressing the torch trigger.
- Air Set Button - To check for proper air setting and to cool down heated torch.

C. MAIN CURRENT CONTROL KNOB

To adjust cutting current. Turning clockwise increases the cutting current and counter clockwise decreases the cutting current.



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D. PRIMARY POWER SWITCH, ON / OFF

The power switch is located on the front panel. Placing the primary power switch to the "ON" position energizes the power source.

WARNING

When the power source is overloaded, the switch turns to the OFF position automatically. DO NOT TURN ON BY FORCE.

4.02 Preparations For Operating

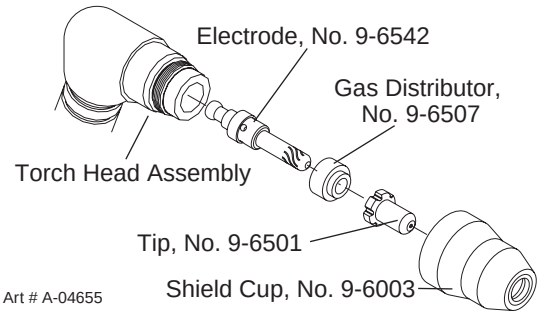
At the start of each operating session:

WARNING

Disconnect primary power at the source before assembling or disassembling power supply, torch parts, or torch and leads assemblies.

A. Torch Parts Selection

Check the torch for proper assembly and appropriate torch parts. The torch parts must correspond with the type of operation, and with the amperage output of this Power Supply (35 amps maximum). Use only genuine manufacturer's parts with this torch.



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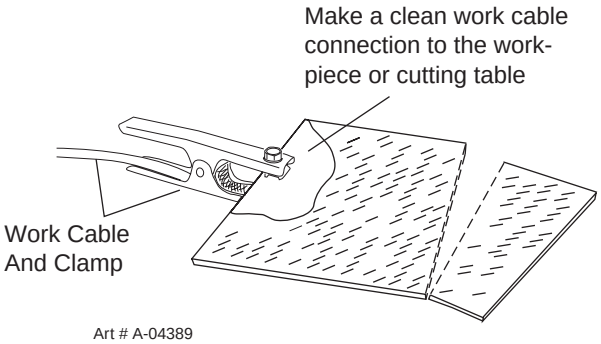
B. Torch Connection

Check that the torch is properly connected.

C. Connect Work Cable

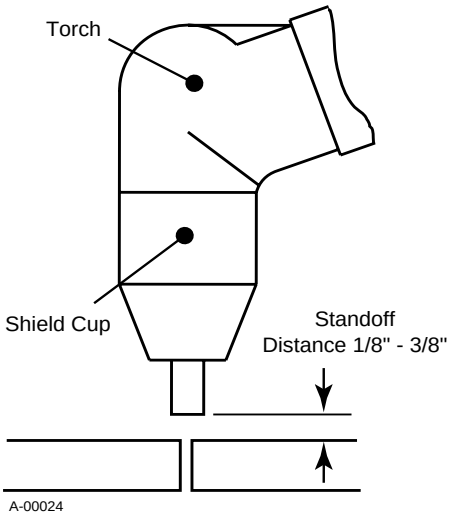


Art # A-04389

D. Torch Operation

- Wear gloves and protective goggles.
- Do not place bare hand on work piece.

1. For **drag cutting**, keep the torch in contact with the workpiece.
2. For **standoff cutting,** hold the torch 1/8 - 3/8 in (3-9 mm) from the workpiece as shown below.



A-00024

3. With the torch in starting position, press and hold the Torch Trigger. After an initial two second pre-flow, the pilot arc will come on and remain on until the cutting arc starts.
4. Once on, the cutting arc remains on as long as the Torch Trigger is held down, unless the torch is withdrawn from the work or torch motion is too slow.
5. To shut off the torch simply release the Torch Trigger. When the trigger is released a gas post-flow will occur. If the Torch Trigger is pushed during the post-flow, the cutting arc will restart immediately when the torch is brought within range of the workpiece.

E. Typical Cutting Speeds

Cutting speeds vary according to torch output, the type of material being cut, and operator skill. Speeds shown are typical for this cutting system using air plasma to cut mild steel, with output current at the highest setting and torch held at the indicated standoff height.

Unit	Standoff	Material Thickness	Maximum Travel Speed		Recommended Travel Speed	
			ipm	mm/m	ipm	mm/m
Drag-Gun Plus	Drag	(10 ga) 0.135" - (3mm)	95.0	2375	76.0	1900
Drag-Gun Plus	Drag	(7 ga) 0.179" - (4.5mm)	57.0	1425	46.0	1150
Drag-Gun Plus	1/8" - (3mm)	1/4" - (6mm)	36.0	900	29.0	725
Drag-Gun Plus	1/8" - (3mm)	3/8" - (9.5mm)	15.0	375	12.0	300
Drag-Gun Plus	1/8" - (3mm)	7/16" - (11mm)	10.0	250	8.0	200
Drag-Gun Plus	1/8" - (3mm)	1/2" - (12mm)	8	200	7	175

NOTE:

Drag or Drag mode refers to the torch tip being in contact with the work piece at all times.

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SECTION 5: MAINTENANCE

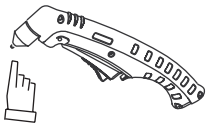
5.01 General Maintenance

Warning!
Disconnect input power before maintaining.

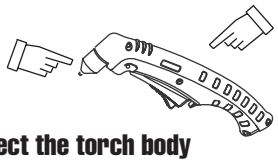
Maintain more often if used under severe conditions

Each Use

Visual check of torch tip and electrode

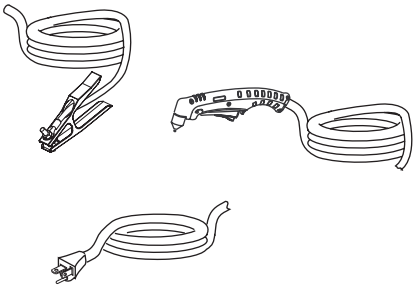


Weekly



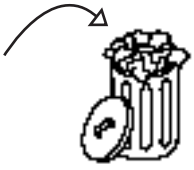
Visually inspect the torch body tip, electrode and shield cup

Visually inspect the cables and leads. Replace as needed

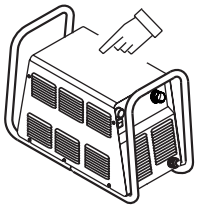


3 Months

Replace all broken parts

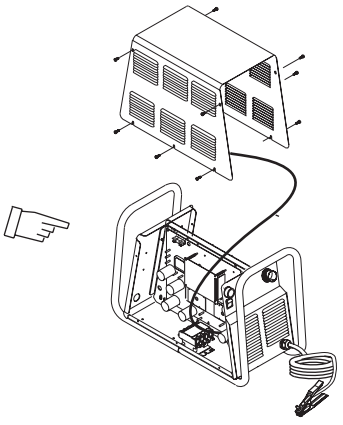


Clean exterior of power supply



6 Months

Visually check and Carefully clean the interior



Art # A-06884

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SECTION 6:
TROUBLESHOOTING

6.01 Normal Setup and Operation

1. Connect the unit to power.
2. Connect the work lead clamp to cleaned area of work surface.
3. Turn the switch located on the front panel, to the "On" position. The A / C indicator on the front panel lights and the cooling fan comes on.
4. Select the correct current setting for the material being cut.
5. Squeeze the torch trigger. The pilot arc and compressor start.
6. Transfer arc to work surface within 3-5 seconds before the pilot arc turns off. If arc was lost before transfer to work surface, release the torch trigger and squeeze the trigger again to establish the pilot arc.
7. When the torch trigger is released, the compressor will continue to run for post flow, approximately 15 seconds.

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques. Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

NOTE:

All procedures are done with the cover removed.

6.02 Basic Trouble Shooting Guide

Problem - Symptom	Possible Cause	Recommended Action
Power Switch is on but the A/C Indicator does not light	1. Improper electrical connection. 2. System was overloaded. 3. Switch may be faulty	1. Check input power source and fuse. Check input cable and connections. 2. Turn Primary Power Switch Off and then On again. 3. Return to authorized service center for repair or replacement
Primary power switch is on, but the cooling fan does not work.	1. No power or incorrect power to fan. 2. Faulty fan.	1. Check electrical connections to fan. 2. Return to authorized service center for repair or replacement
No air flow at torch when air check switch is turned on.	1. Internal connection is loose or disconnected. 2. Internal air supply / compressor not working. 3. Control PCB faulty	1. Check all air line connections and fittings. 2. Return to an authorized service center for repair. 3. Return to an authorized service center for repair.
Torch will not pilot when torch switch is activated.	1. Air pressure too high or too low. 2. Torch consumables missing. 3. Worn or faulty torch parts 4. Thermal Switch activated	1. There is no adjustment, return to an authorized service center for repair.. 2. Turn off power supply. Remove shield cup. Install missing parts. 3. Inspect torch consumable parts. Replace if necessary. 4. Allow the cooling fan to run for 2 minutes or longer until it will resume operation.
Pilot / transfer arc goes out and doesn't reactivate	1. Torch removed from work piece or moved away from metal being cut	1. Release torch trigger and re-establish the pilot arc. See block diagram Appendix 1
Cut performance is diminished.	1. Worn torch parts. 2. Poor Work Lead connection. 3. Current sensor or PWM PCB faulty.	1. Check current setting. Check the Electrode and Tip for excess wear. 2. Check the connection of the Work Lead to the work piece. 3. Return to an authorized service center for repair or replacement.
Air flows continuously and torch switch latch button doesn't work properly.	1. Torch Switch Latch button on front panel faulty. 2. Control PCB faulty.	1. Return to an authorized service center for repair or replacement. 2. Return to an authorized service center for repair or replacement.

6.03 Control PCB Indicators

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

NOTE:

All procedures are done with the cover removed.

1. Turn the switch located on the front panel, to the "On" position. The A / C indicator on the front panel lights and the cooling fan comes on.
2. Locate the Control PCB behind the front panel. LD2 (EN) LED should be "ON".

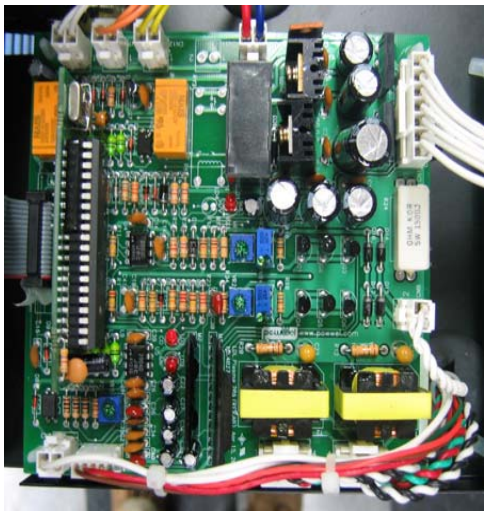


Illustration 6-1, Control PCB

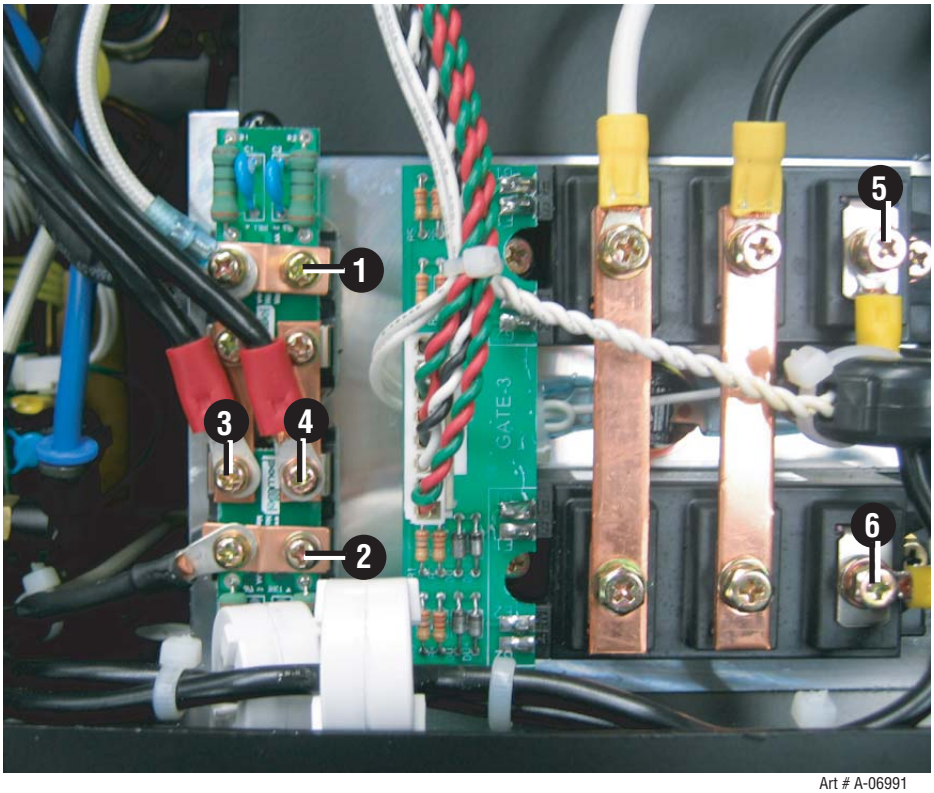
3. Press the Air Set Button . The the air compressor should come on causing air to flow through the torch and LD1 (SOL) LED should light. Press the Air Set Button again and the air compressor stops and the LED goes out.
4. Squeeze the torch trigger. The pilot arc and compressor start. LD2 (EN) should brighten and LD1 (SOL) LED and LD4 (H / V) should be on.
5. Transfer the arc to the work surface within 3-5 seconds. LD4 goes off and LD3 comes on so that three LEDs are on.

NOTE:

If no transfer of arc occurs, check the work lead connection.

6.04 Open Circuit Voltage Check

1. Unplug the CN1 connector on the H / V (spark gap) PCB.
2. Turn unit power on.
3. Measure terminal TB2, Pins 1 and 3. It should be 230VAC.
4. Measure output voltage on Input diode (+ and -). It should be 325VDC.
5. Depress and hold the torch trigger for each of the following checks / steps, numbers 6 - 9. Each check has to be done within the 3-5 second pilot arc time. If not, then the trigger will have to be releaed and then depressed again.
6. Check for illumination of the "SOL" LED and that the "EN" (Enable) LED brightens on the Logic PCB.



Art # A-06991

Illustration 6-2

7. Measure output to Main Transformer Input between points 5 and 6 in Illustration 6-2 above. It should be 220VAC.
8. Measure Main Transformer secondary voltage between points 3 and 4 in Illustration 6-2 above. It should be 190VAC.
9. Measure output OCV between points 1 and 2 in Illustration 6-2 above. It should be 325VDC.
10. Turn off the unit power and plug the connector back in to CN1, removed in step 1 above.

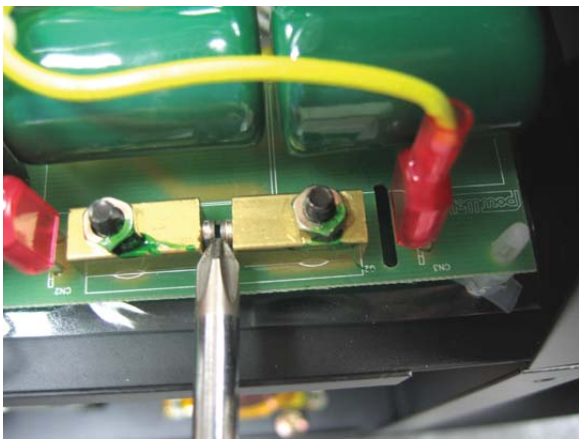
6.05 Detailed Fault Finding / Error Indicators

Problem	Check / Test	Recommended Action
Air Indicator is on and or audible intermitant tone	1 - Check air and electrical connections to the internal air compressor 2 - Control PCB faulty 3 - Check the compressor relay	1 - If connections are good, return to an authorized service center for repair. 2 - Replace the Control PCB 3 - Replace the relay if bad.
Torch doesn't Pilot and the LD1 LED light on the Control PCB **is** on	1 - Check torch consumables. 2 - Check all air supply related issues before proceding. 3 - Check LD2 (EN) LED it should get brighter with the torch trigger depressed. 4 - Check OCV Voltage. If OCV Voltage is OK check C/T 1 connection	1 - Replace torch consumables as needed. 2 - Change air related items as needed. 3 - If OCV is not OK, follow OCV check procedures in section 6.04 4 - If CN9 connection is OK, replace the Control PCB
Torch doesn't Pilot and the LD1 LED on the Control PCB is **not** on	Check all air supply related issues before proceding.	If there are no air related issues, replace the Control PCB
"CO" LED on Control PCB comes on when not transferring.	Check Cable Connection on PCB (CN10) and Current Sensor.	If connection and Current Sensor are OK, replace the Control PCB

A. Diode Testing Basics

WARNING

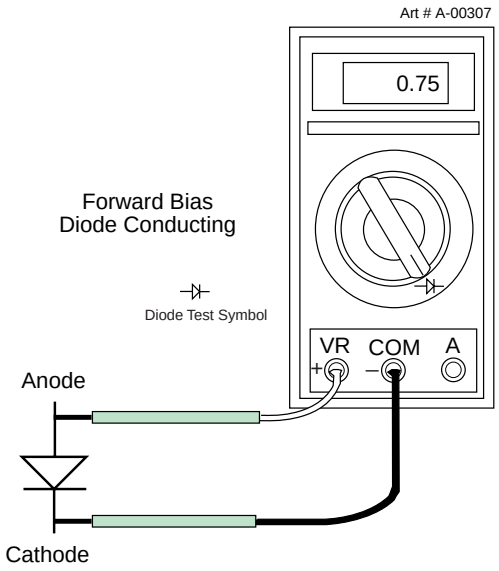
There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques. Disconnect primary power at the source before disassembling the power supply, torch, or torch leads. Discharge power at the H/V spark gap using a metal tipped screw driver as shown:



Art # A-07116

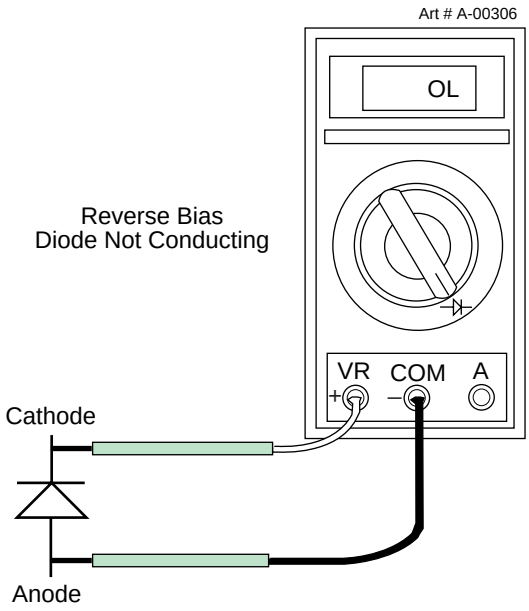
Testing of diode modules requires a digital volt / ohmmeter that has a diode test scale. Remember that even if the diode module checks good, it may still be bad. If in doubt, replace the diode module.

1. Remove AC power. Refer to Appendix 3 Wiring diagram.
2. Locate the IGBT diode module to be tested.
3. Remove P5 from IGBT module.
4. Set digital volt / ohmmeter to diode test scale.
5. Connect the volt / ohmmeter positive lead to the anode (+) of the diode and the negative lead to the cathode (-) of the diode for forward bias testing (refer to following figure). A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.



Testing Diode Forward Bias

6. Reverse the meter leads across the diode for reverse bias testing (refer to following figure). A properly functioning diode will block in the reverse bias direction and depending on the meter function will indicate an open or "OL".



Testing Diode Reverse Bias

7 Using the Figures for each test, check each diode in the module. Each diode must be checked in forward bias (plus to negative) and reverse bias (negative to plus) direction.

B. Component Tests

WARNING

Disconnect primary power at the source before taking any resistance checks.

1. Input Diode Module Board Circuit Test

a. Check Input Diode for short per schematic located in Appendix 4.

2. IGBT Module Test

a. With an ohmmeter set on the diode range remove P5 from the IGBT and make the following IGBT checks:

Gate PCB J5 IGBT Check		
+	-	
E1	White +	DD (1.020)
White +	E1	Open After Charging
E1	Black -	Open After Charging
Black -	E1	DD (1.270)
E1	G1	DD (.770)
G1	E1	DD (.770)
E2	G2	DD (.770)
G2	E2	DD (.770)
E3	White +	DD (1.270)
White +	E3	Open After Charging
E3	Black -	DD (.770)
Black -	E3	DD (.770)
G3	E3	DD (.770)
E3	G3	DD (.770)
G4	E4	DD (.770)
E4	G4	DD (.770)

Diode Test

P5 Gate Connector			Control Connector		
1	G1 Black	TW	CN8	1	Black
2	E1 White			2	White
3	G2 Green	TW		3	Green
4	E2 Red			4	Red
5	G3 Black	TW	CN6	1	Black
6	E3 White			2	White
7	G4 Green	TW		3	Green
8	E4 Red			4	Red

Pin-out diagram

b. If reading is not as shown, replace both IGBT modules and Gate PCB.

c. Reconnect P5 connector.

6.06 Torch Tests

WARNING

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

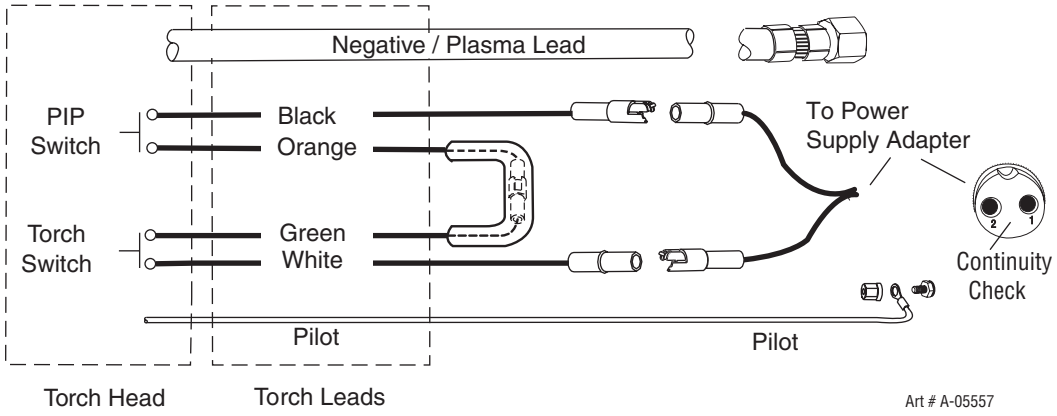
1. PIP and Torch Switch Adapter Check

a. Disconnect input power from power supply.

b. Confirm that the torch parts are in place and that they match the parts consumables label on the power supply cover.

c. Refer to Appendix 2 for torch connection and access. With the power supply on it's side and the panel removed, disconnect the Power Supply Adapter from the power supply.

d. While the torch trigger is depressed, complete an Ohm check on the two pins in the Power Supply Adapter . The reading should show a short (less than 1 Ohm). Refer to diagram.



2. Shorted Torch Check

a. Disconnect input power from power supply.

b. Disconnect the pilot lead (see previous diagram).

c. Perform an Ohm check of the pilot lead to the negative lead. This should show "Open". If it does not show "Open", check that the correct consumables were installed per the consumables label on the unit cover.

d. Replace Torch as needed.

NOTE

Every effort has been made to provide complete and accurate information in this manual. However, the publisher does not assume and hereby disclaims any liability to any party for any loss or damage caused by errors or omissions in this Manual, whether such errors result from negligence, accident, or any other cause.

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SECTION 7:
PARTS LIST

General Information

This parts list covers the Drag-Gun Plus® Model 35C Plasma Cutting Power Supply with Internal Air Compressor. Do not use these instructions or parts on any other equipment.

Provide the power supply model number and serial number when ordering parts.

If a product must be returned for service, contact your distributor. Materials returned without proper authorization will not be accepted.

Contact Information

Thermal Dynamics Technical Service Dept.

Tel: 1-800-752-7622 (1-800-PLASMA2)

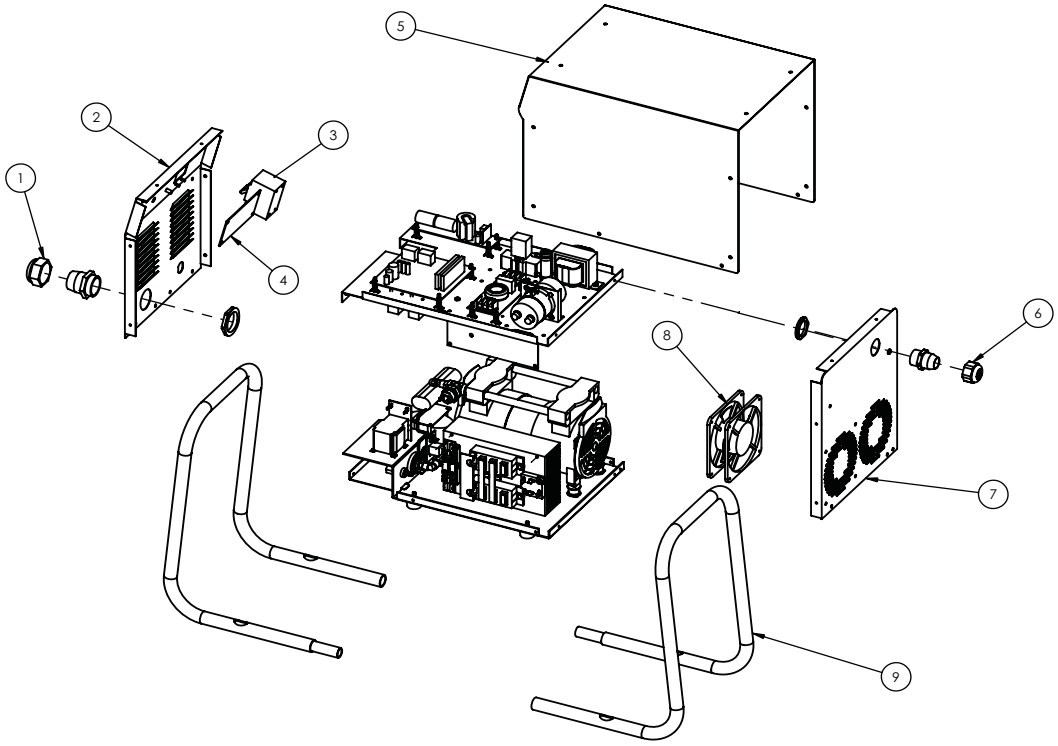
Fax: 1-800-221-4401

e-mail address: tdc-tech@thermadyne.com

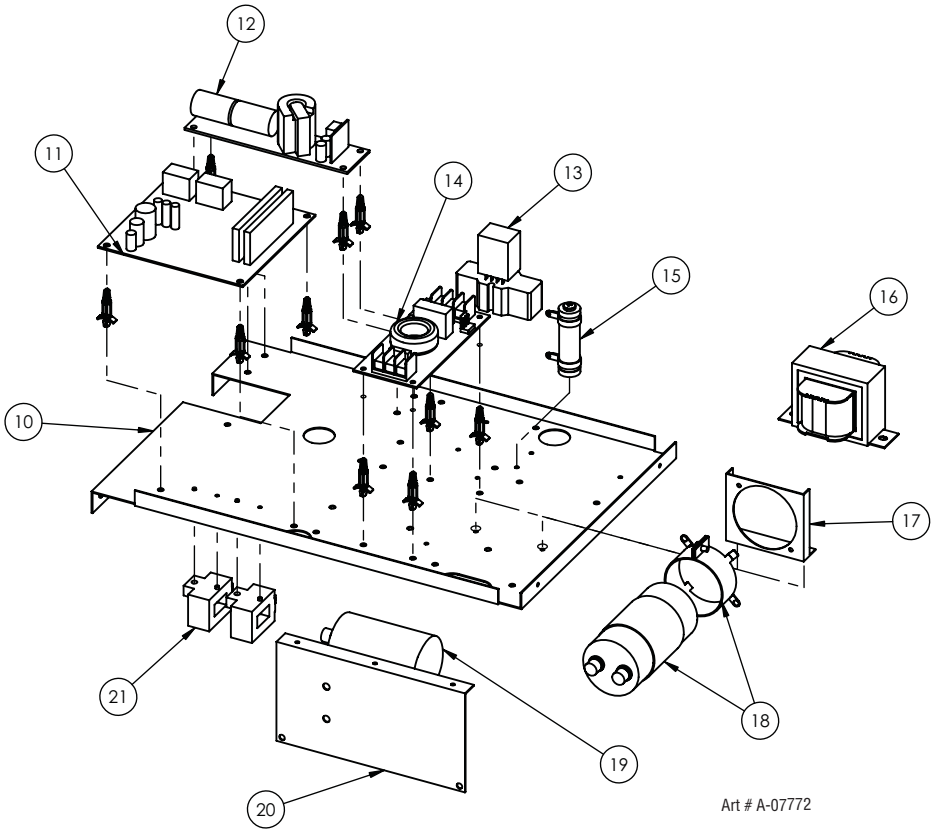
Replacement parts are shown on the following pages. Catalog numbers are shown below each part.

7.01 Parts List Power Supply

Item Number	Quantity	Description	Catalog Number
1	1	Cable Ground PG29	9-0382
2	1	Case, Front	9-0309
3	1	Circuit Breaker	9-7143
4	1	PCB-Front	9-7117
5	1	Cover-Drag Gun Plus	9-7217
6	1	Cable Ground PG21	9-0296
7	1	Case, Back	9-0311
8	1	Cooling Fan	9-7163
9	1	Case, Roll Bar	9-7218
10	1	Case, Top	9-0312
11	1	PCB-Control	9-7181
12	1	H/V PCB	9-7147
13	1	Relay	9-0319
14	1	PCB-Input Filter (shown)	9-7128
14	1	PCB-Input Filter (CE)	9-7133
15	1	Resistor	9-0300
16	1	Control Transformer	9-7144
17	1	Bracket, Capacitor	9-0302
18	1	Electrolytic Capacitor Assembly	9-0303
19	1	Compressor Part	9-0320
20	1	Bracket, Upper	9-0313
21	1	Current Sensor	9-7153
22	1	Case, Torch Cover	9-0314
23	1	Pilot Relay Assembly	9-0304
24	1	Connector	9-0305
25	1	Heat Sink Assembly	9-0306
26	1	Compressor Assembly	9-0316
27	1	Rubber Bushing	9-0318
28	1	PCB-Torch Filter	9-7121
29	1	Case, Bottom-Drag Gun Plus	9-0322
30	1	Main Trans and Reactor Assy	9-0315



Art # A-07771



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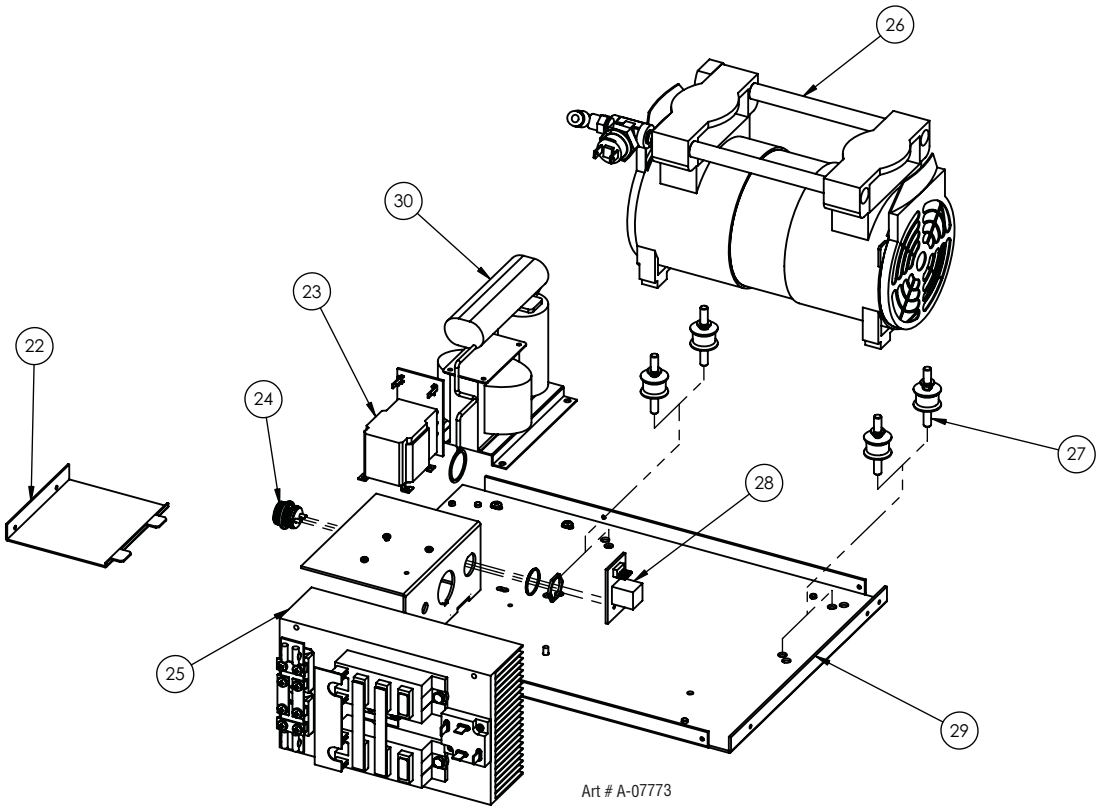
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30
23
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25
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Art # A-07773

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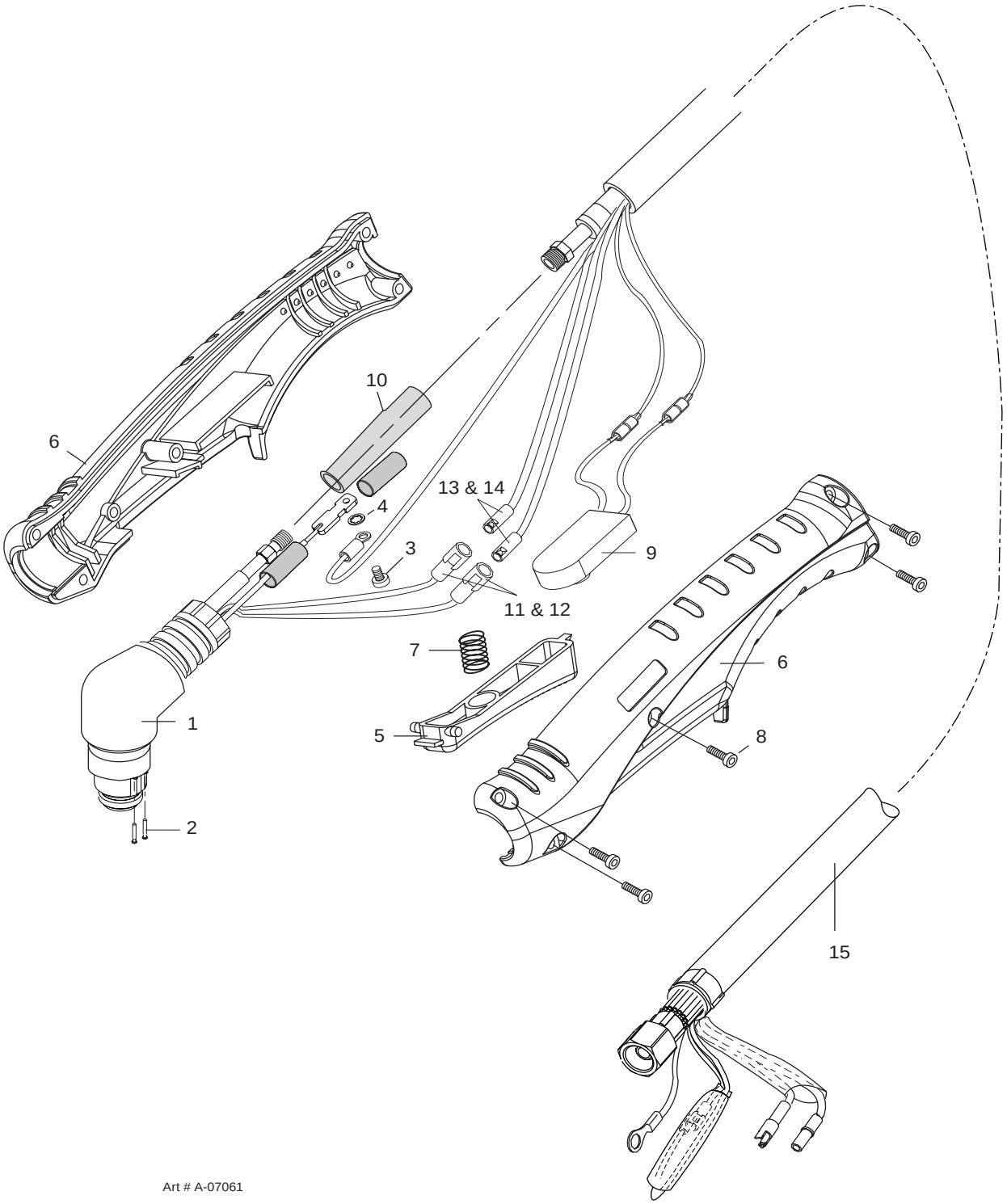
7.02 Replacement Hand Torch Parts With Ergonomic Handle

Item #	Qty	Description	Catalog #
1	1	Assembly, Basic Head	
		70° Head	9-8442
2	2	PIP (Parts - In - Place) Pins	9-5723
3	1	#6-32 x 3/16" Phillips Pan Head Screw	See Note
4	1	#6 Internal Star Washer	See Note
	1	Ergonomic Handle, Split, with Trigger (includes items #5 - 12)	9-8076
5	1	Trigger, Lexan, Orange	9-8059
6	1	Handle	9-8060
7	1	Spring, 0.390 O.D. x 0.750	9-8061
8	1	Torch Handle Socket Head Cap Screw Kit (5 pcs 6-32 x 1/2")	9-8062
9	1	Assembly, Torch Switch	9-8063
10	1	Negative / Plasma Lead Insulation Sleeving	9-8056
11	3	Pin Housing (Used with item #12)	9-8111
12	3	Pin	9-8101
13	3	Socket Housing (Used with item #14)	9-8112
14	3	Socket	9-8102
15	1	Lead Assembly, including items No. 6, 8, and 9	
		20 ft (7.6 m) Length	4-2989

NOTE: Item can be purchased locally.



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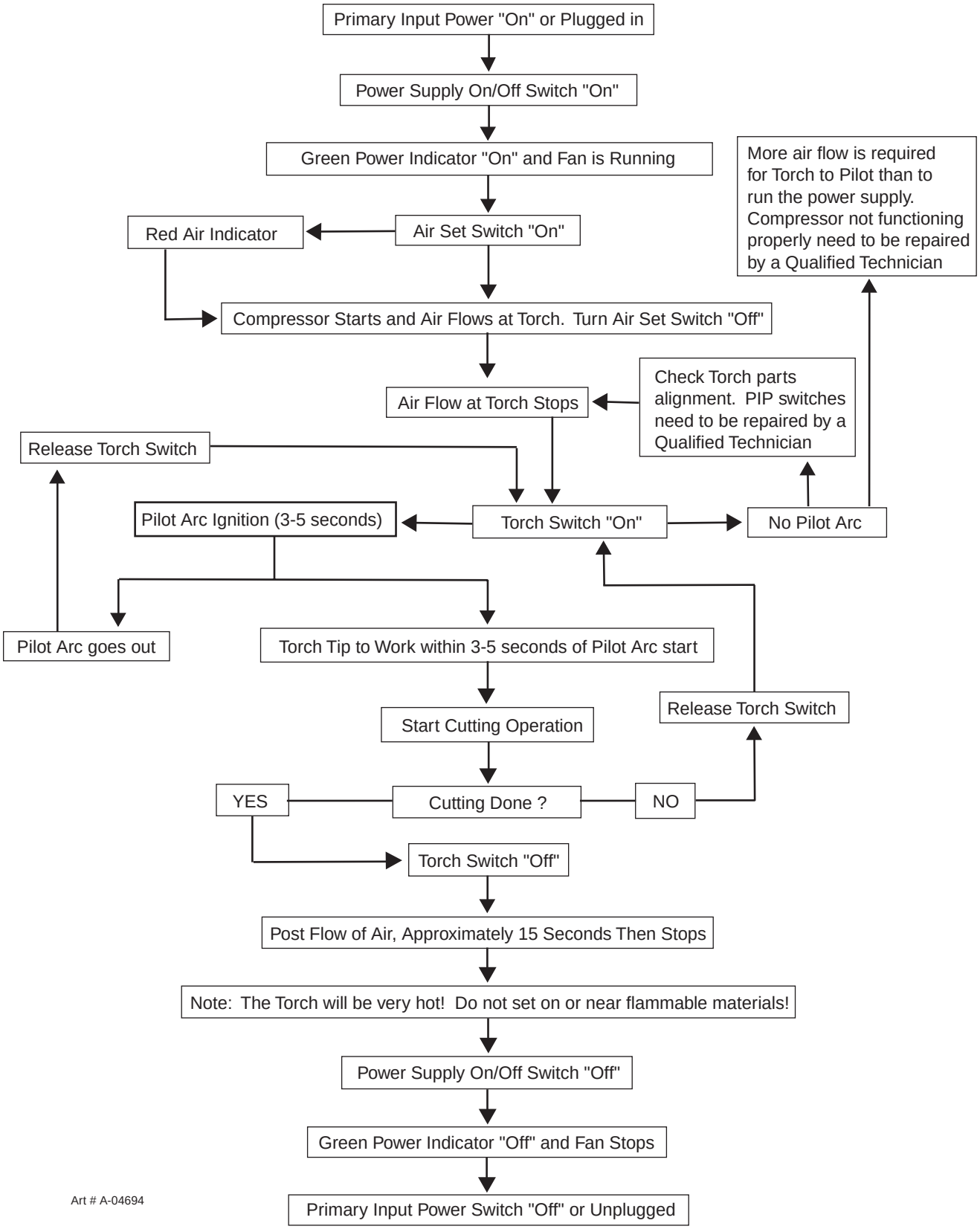
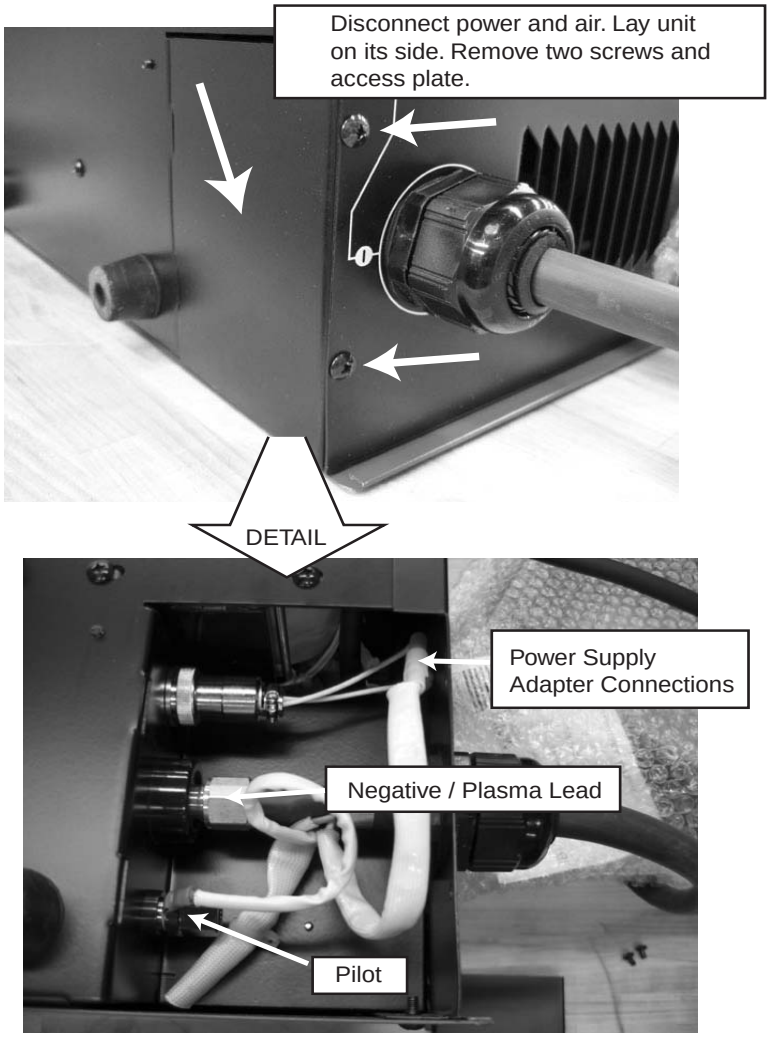
Appendix 1: Operating Sequence, Block Diagram

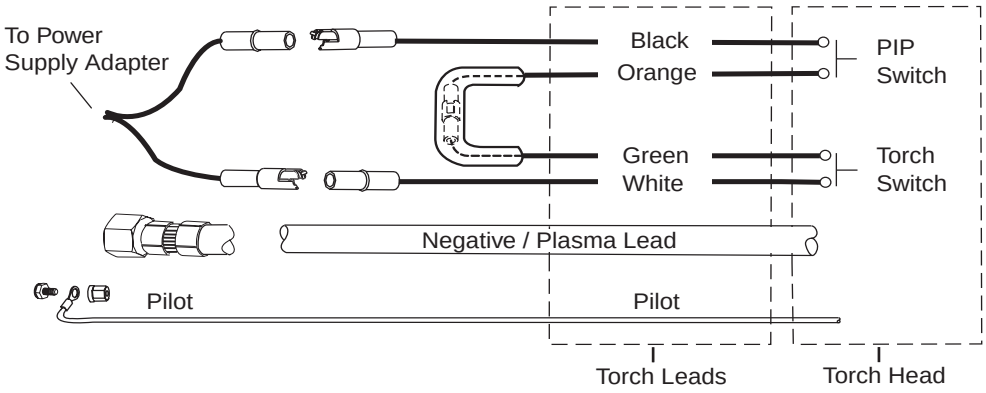

Primary Input Power "On" or Plugged in
Power Supply On/Off Switch "On"
Green Power Indicator "On" and Fan is Running
More air flow is required for Torch to Pilot than to run the power supply. Compressor not functioning properly need to be repaired by a Qualified Technician
Red Air Indicator
Air Set Switch "On"
Compressor Starts and Air Flows at Torch. Turn Air Set Switch "Off"
Check Torch parts alignment. PIP switches need to be repaired by a Qualified Technician
Air Flow at Torch Stops
Release Torch Switch
Pilot Arc Ignition (3-5 seconds)
Torch Switch "On"
No Pilot Arc
Pilot Arc goes out
Torch Tip to Work within 3-5 seconds of Pilot Arc start
Release Torch Switch
Start Cutting Operation
YES
Cutting Done ?
NO
Torch Switch "Off"
Post Flow of Air, Approximately 15 Seconds Then Stops
Note: The Torch will be very hot! Do not set on or near flammable materials!
Power Supply On/Off Switch "Off"
Green Power Indicator "Off" and Fan Stops
Primary Input Power Switch "Off" or Unplugged

Art # A-04694

Appendix 2: Torch Connection

Art # A-04695

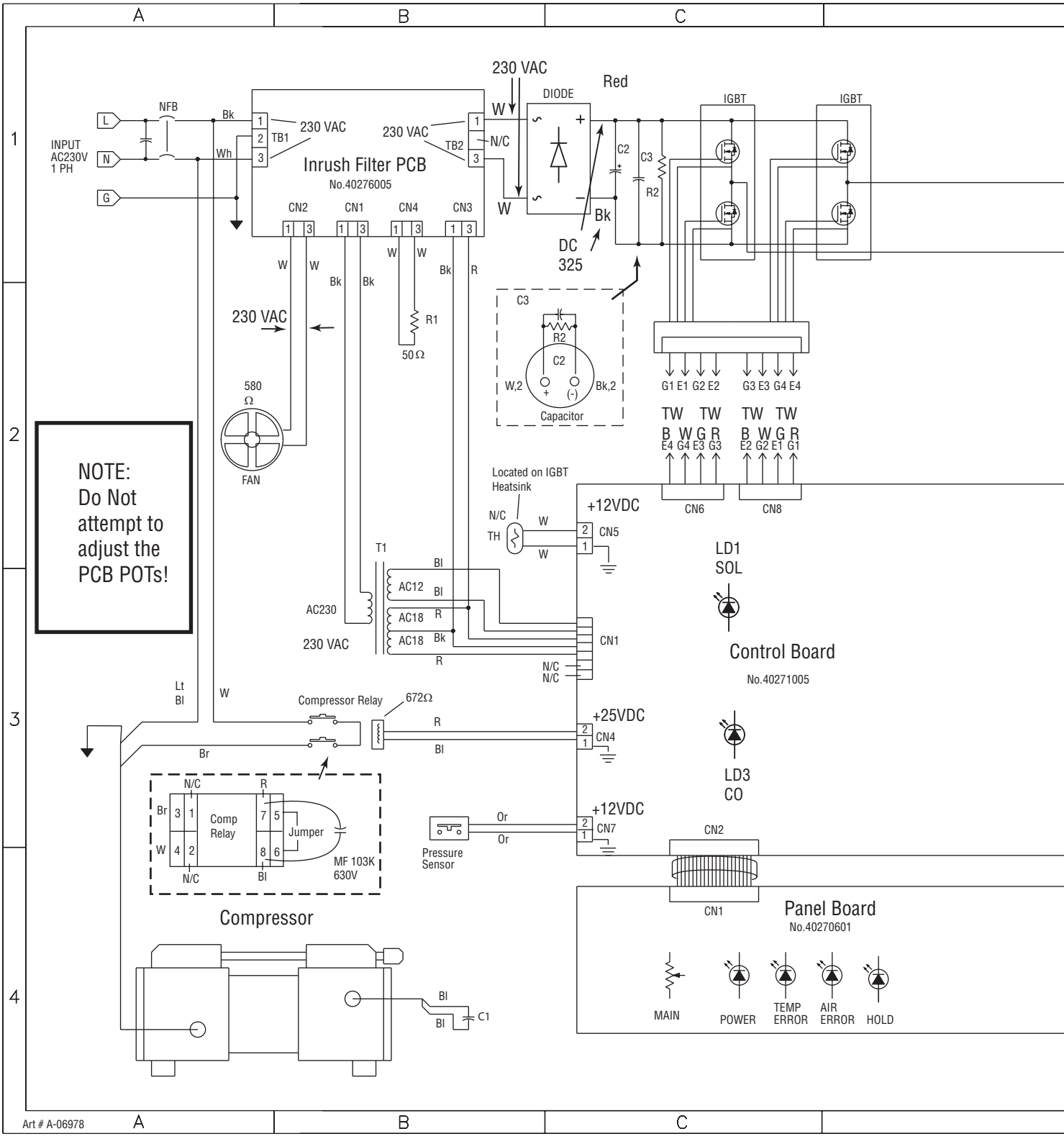

Disconnect power and air. Lay unit on its side. Remove two screws and access plate.
DETAIL
Power Supply Adapter Connections
Negative / Plasma Lead
Pilot

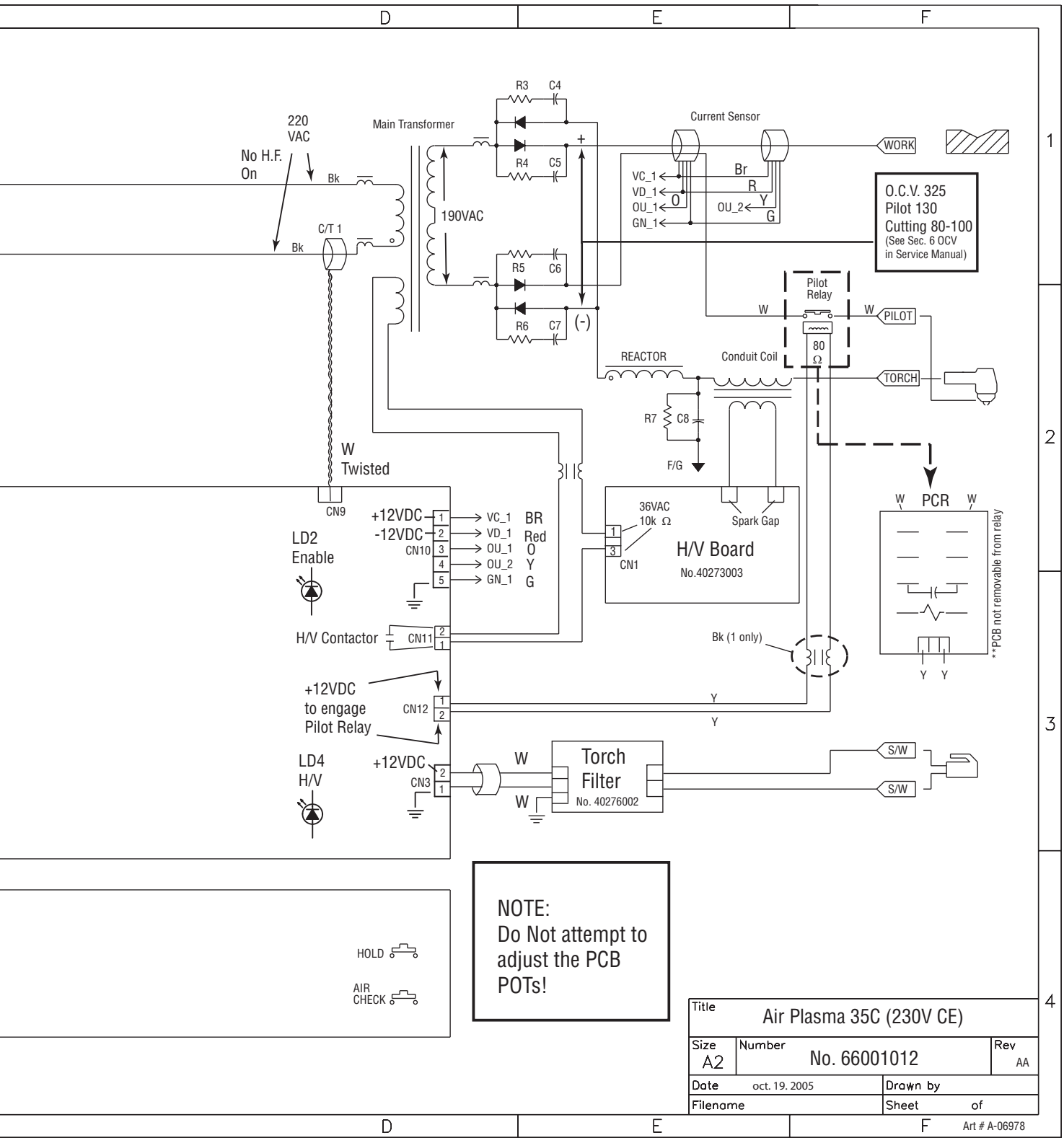


Appendix 3: Microchip Pin-Out

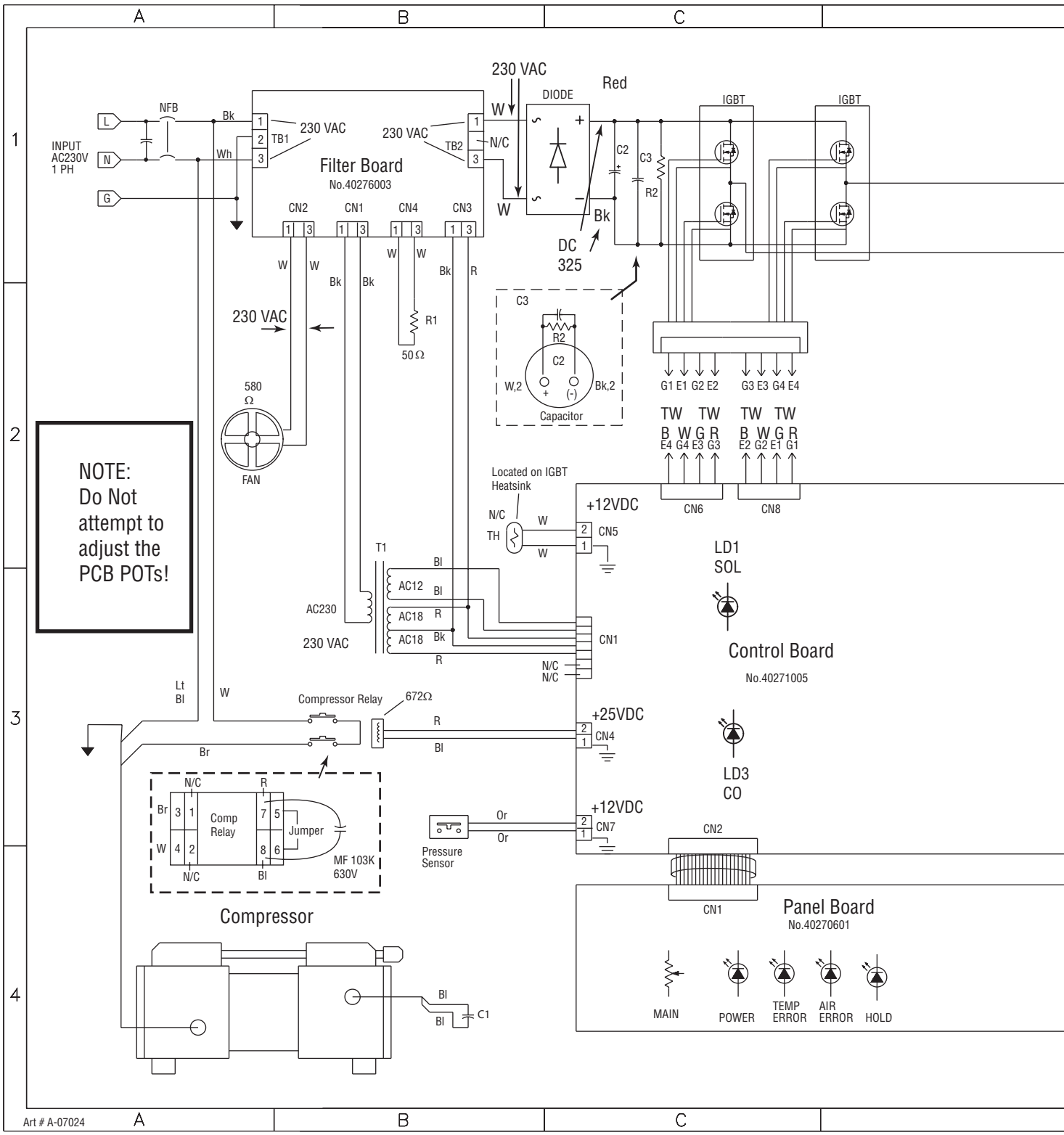
40 Pin Microchip												
CPU Socket on Control PCB	P2	1	2	3	4	5	6	7	8	9	10	11	12
	P1	24	22	20	18	16	14	12	10	8	6	4	2
		23	21	19	17	15	13	11	9	7	5	3	1
	P3	1	2	3	4	5	6	7	8	9	10	11	12

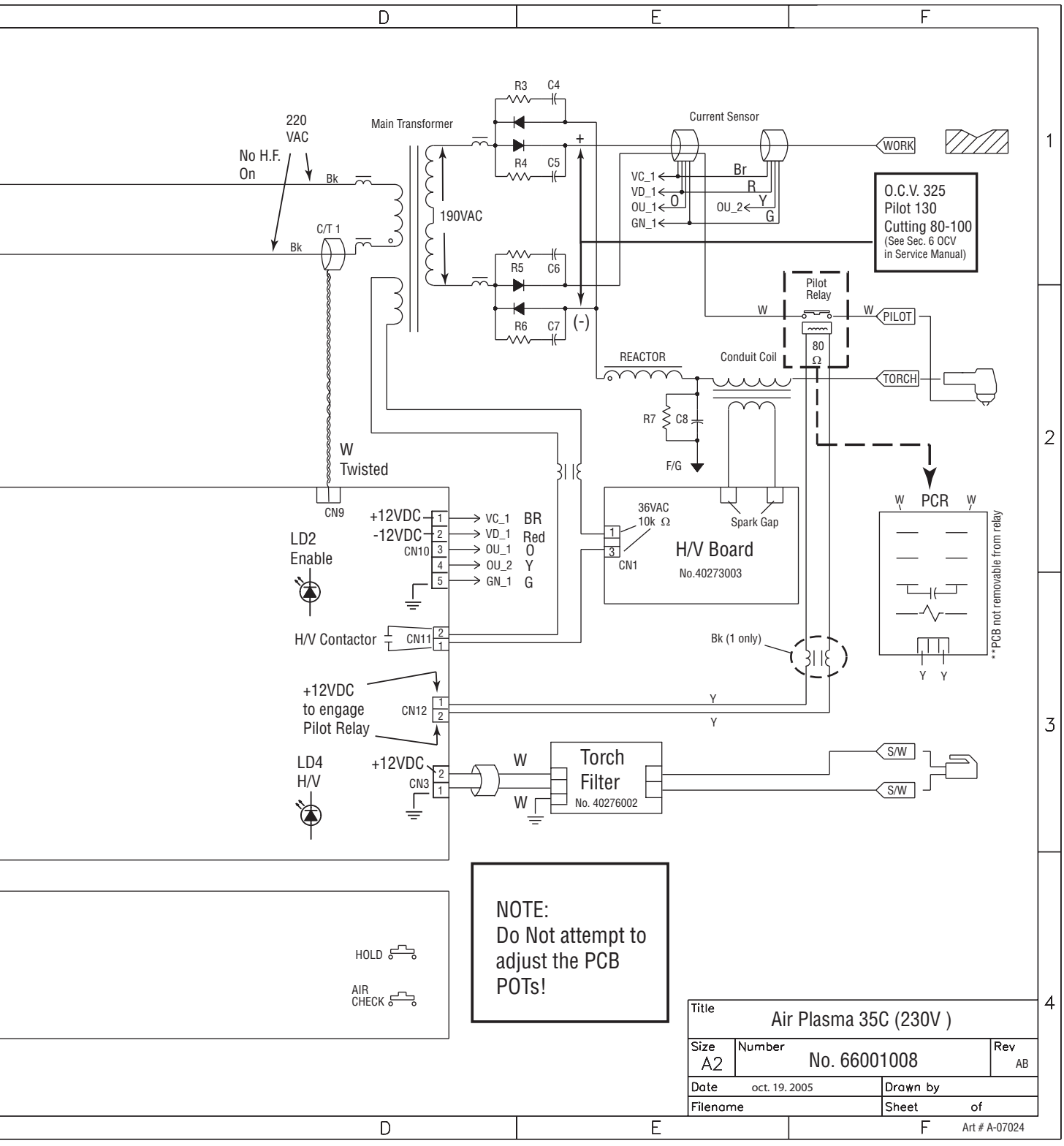
Appendix 4: System Schematic 230V CE




D
E
F
1
2
3
4
R3
C4
R4
C5
R5
C6
R6
C7
220
VAC
No H.F.
On
Bk
C/T 1
Main Transformer
190VAC
+
(-)
Current Sensor
VC_1
VD_1
OU_1
GN_1
Br
R
O
Y
G
OU_2
WORK
O.C.V. 325
Pilot 130
Cutting 80-100
(See Sec. 6 OCV
in Service Manual)
Pilot
Relay
W
PILOT
80
Ω
REACTOR
Conduit Coil
TORCH
R7
C8
F/G
W
Twisted
CN9
+12VDC
-12VDC
CN10
VC_1
VD_1
OU_1
OU_2
GN_1
BR
Red
O
Y
G
LD2
Enable
36VAC
10k Ω
CN1
H/V Board
No.40273003
Spark Gap
PCR
**PCB not removable from relay
H/V Contactor
CN11
Bk (1 only)
+12VDC
to engage
Pilot Relay
CN12
LD4
H/V
+12VDC
CN3
W
Torch
Filter
No. 40276002
S/W
HOLD
AIR
CHECK
NOTE:
Do Not attempt to
adjust the PCB
POTs!
Title
Air Plasma 35C (230V CE)
Size
A2
Number
No. 66001012
Rev
AA
Date
oct. 19. 2005
Drawn by
Filename
Sheet
of
Art # A-06978

Appendix 5: System Schematic 230V




D
E
F
1
2
3
4
220 VAC
No H.F. On
Bk
Bk
C/T 1
Main Transformer
190VAC
R3
C4
R4
C5
R5
C6
R6
C7
+
(-)
Current Sensor
VC_1
VD_1
OU_1
GN_1
Br
R
O
OU_2
Y
G
WORK
O.C.V. 325
Pilot 130
Cutting 80-100
(See Sec. 6 OCV in Service Manual)
Pilot Relay
W
W
PILOT
80 Ω
REACTOR
Conduit Coil
TORCH
R7
C8
F/G
W
Twisted
CN9
+12VDC
-12VDC
CN10
VC_1 BR
VD_1 Red
OU_1 O
OU_2 Y
GN_1 G
LD2
Enable
36VAC
10k Ω
CN1
H/V Board
No.40273003
Spark Gap
W
PCR
W
** PCB not removable from relay
Y
Y
H/V Contactor
CN11
Bk (1 only)
+12VDC
to engage
Pilot Relay
CN12
Y
Y
LD4
H/V
+12VDC
CN3
W
W
Torch
Filter
No. 40276002
S/W
S/W
HOLD
AIR
CHECK
NOTE:
Do Not attempt to adjust the PCB POTs!
Title
Air Plasma 35C (230V)
Size
A2
Number
No. 66001008
Rev
AB
Date
oct. 19. 2005
Drawn by
Filename
Sheet
of
Art # A-07024

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GLOBAL CUSTOMER SERVICE CONTACT INFORMATION

Thermadyne USA
2800 Airport Road
Denton, Tx 76207 USA
Telephone: (940) 566-2000
800-426-1888
Fax: 800-535-0557

Thermadyne Canada
2070 Wyecroft Road
Oakville, Ontario
Canada, L6L5V6
Telephone: (905)-827-1111
Fax: 905-827-3648

Thermadyne Europe
Europe Building
Chorley North Industrial Park
Chorley, Lancashire
England, PR6 7Bx
Telephone: 44-1257-261755
Fax: 44-1257-224800

Thermadyne, China
RM 102A
685 Ding Xi Rd
Chang Ning District
Shanghai, PR, 200052
Telephone: 86-21-69171135
Fax: 86-21-69171139

Thermadyne Asia Sdn Bhd
Lot 151, Jalan Industri 3/5A
Rawang Integrated Industrial Park - Jln Batu Arang
48000 Rawang Selangor Darul Ehsan
West Malaysia
Telephone: 603+ 6092 2988
Fax : 603+ 6092 1085

Cigweld, Australia
71 Gower Street
Preston, Victoria
Australia, 3072
Telephone: 61-3-9474-7400
Fax: 61-3-9474-7510

Thermadyne Italy
OCIM, S.r.L.
Via Benaco, 3
20098 S. Giuliano
Milan, Italy
TTel: (39) 02-36546801
Fax: (39) 02-36546840

Thermadyne International
2070 Wyecroft Road
Oakville, Ontario
Canada, L6L5V6
Telephone: (905)-827-9777
Fax: 905-827-9797

Corporate Headquarters
16052 Swingley Ridge Road
Suite 300
St. Louis, MO 63017
Telephone: 636-728-3000
Email: TDCSales@Thermadyne.com
www.thermadyne.com

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